OPTIMAL MODEL FOR DEPLOYMENT OF WIRELESS SENSOR NETWORKS FOR LARGE SYSTEMS

SHORT SYNOPSIS

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Certificate

I hereby, declare that the short synopsis "Optimal model for deployment of wireless sensors networks for large scale system" being submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in Electronics and communication under faculty of FET of Manav Rachna International Institute of Research & Studies, Faridabad during the academic year 2018

It is a bona fide record of original work carried out under the supervision of Prof. (Dr.) M.K. Soni and has not been submitted in full or part to any other university or institute for degree or diploma. Further, it is certified that short synopsis is plagiarism free and proof has been submitted.

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ABSTRACT

Wireless sensor network is one of the very important area in Internet of things (IoT). A Wireless sensor network epitomizes a new generation of real time embedded system with considerably different communication constraints from the traditional network system. Basically, the wireless sensor network is comprised of computing, communication and sensing elements which gives the opportunity to the administrator to an object, sense and an instrument in the events in a specified environment. They are popular due to unique and advance property of wireless sensor but they have fundamental problems like limited battery life, overhearing, coverage area, node deployment, blindness and much more. Wireless sensor networks accomplish many tasks which include smart sensing, data aggregation, data processing, storage etc. To perform these tasks large number of algorithm are available. Some gaps are found after surveying the relevant literature/algorithms. These gaps are concerned to limited battery life, overhearing, coverage area, node deployment, blindness and much more. To accomplish these gaps new/modified algorithms will be investigated and optimal model will be explored for deployment of wireless sensor networks in large scale for more efficiency.

Key words: Wireless sensor network (WSN), deployment and data gathering, coverage, storage and life time of the network.

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INTRODUCTION

Wireless sensor network is one of the very important areas in IoT (Internet of things). According to (Sohraby, Minoli and Znati 2007) “Wireless sensor network (WSN) can be defined as the wireless network that consists of spatially distributed autonomous devices that wield sensors to invigilate physical or environmental conditions. Wireless sensor network epitomizes a new generation of real time embedded system with considerably different communication constraints from the traditional network system.”Basically, the wireless sensor network is comprised of computing, communication and sensing elements which gives the opportunity to the administrator to an object and sense the events in a specified environment.

The wireless sensor network consists of four basic components:-

(1) The centre point of clustering information,

(2) A congregation of localized or distributed sensors,

(3) A set of computing methods to maintain the current events and

(4) The intercommunication of the network.

In wireless sensor networks the data is forwarded through the number of nodes from the base station, these nodes are also known as motes. Basically motes are the wireless devices which are multifunctional and energy efficient. In other words motes are the tiny computers that work collectively in order to form a network. Motes are the key for environmental applications of wireless sensor networks. A group of motes gathers the signal from the environment to execute a particular target. There are hundreds or even thousands number of sensor nodes in wireless sensor network while other sensor network like, Ad hoc networks have very less number of nodes and even without infrastructure. The comparison between Ad hoc networks and wireless sensor network is shown in the Table-1.

Now a day's wireless sensor networks have become novel, wide and most popular topic for researchers due to its best performance in the commercial and industrial applications because wireless sensor networks uses low power computing embedded devices and advance communication and processor. The main objective of sensor nodes in wireless sensor network are to sense, monitor and detect the parameters, for example, for environmental phenomenon that are sound, temperature, light, pressure, vibration, humidity etc.

The sensors nodes are also accomplishing many tasks in different kinds of applications which include smart sensing, data aggregation, data processing, storage etc.

Table: 1: Comparison between the wireless sensor networks and ad hoc network

Parameters	Wireless sensor network	Ad hoc network
1 Communication paradigm	Broadcast communication	Point-to-point communication
2 Deployment	Densely deployed	Scattered
3 Topology	Changes very frequently	Very rare
4 Centric	Data centric	Address centric
5 Computational	Limited	Not limited
6 Number of sensor nodes	Large	Medium
7 Failure rate	Prone to failure	Very rare
8 Redundancy	High	Low
9 Battery	Not replaceable	Replaceable
10 Memory	Limited	Not limited

11 Data rate	Low	High
12 Identifiers	No unique identifiers	Unique identifiers
13 Aggregation/fusion	Possible	Not possible
14 Capacities	Low	High

The architecture of sensor nodes in wireless sensor networks is comprised of sensing unit, power unit, communication unit and processing unit. The data gathering, processing, communicating and sensing is takes place due to each and every motes of wireless sensor networks. The sensing unit firstly senses the information from the environment then transfer to the processing unit, processing unit then computes the collected data and handovers it to communication unit, the communication unit sends the computed data into the neighbourhood sensing nodes. Figure:-1 shows the Basic block diagram of wireless sensor network (Li and Thai, 2008).

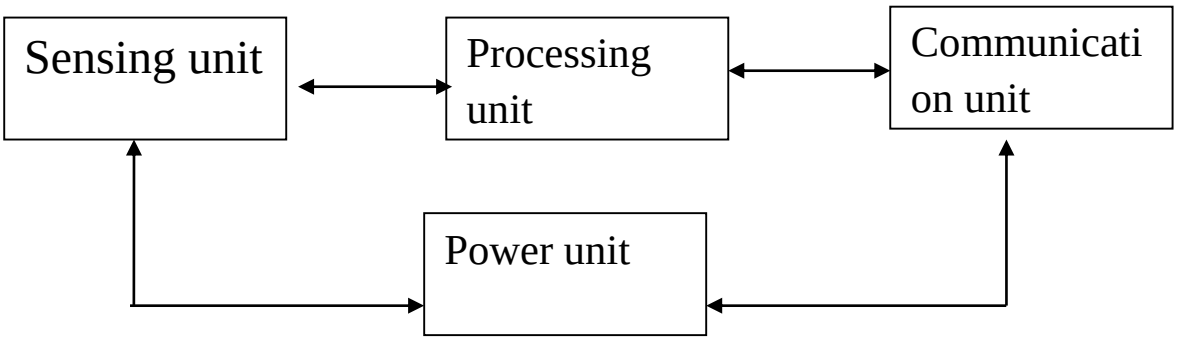


Figure1. Basic block diagram of wireless sensor network

1.2 BACKGROUND

Wireless sensor network (WSN) has given the researchers an exciting acclivitous domain of deeply networked systems with small amount of computers and memory and less power wireless nodes. To understand the establishment in today's wireless sensor network, it's very beneficial to learn its history. For example: its technologies, origin, consumer and application. The sound surveillance system is the first wireless network that track and detect the soviet submarines and developed by "United states military in 1950s. The sound surveillance system is still in use. Figure:-2 show the Traditional model of wireless sensor network Wireless sensor network covers large number of capabilities, functions and purpose. The examples of today's deployment sensor networks are the national electrical power grid, to

control air traffic the radar network is used and besides regular topographic the nationwide weather station is deployed. However these all systems used communication protocols, consequently and specialized computers which are very expensive. So researchers are now developing sensors for novel applications such as health care, military, security and agriculture which are less expensive (Agashe, 2014).

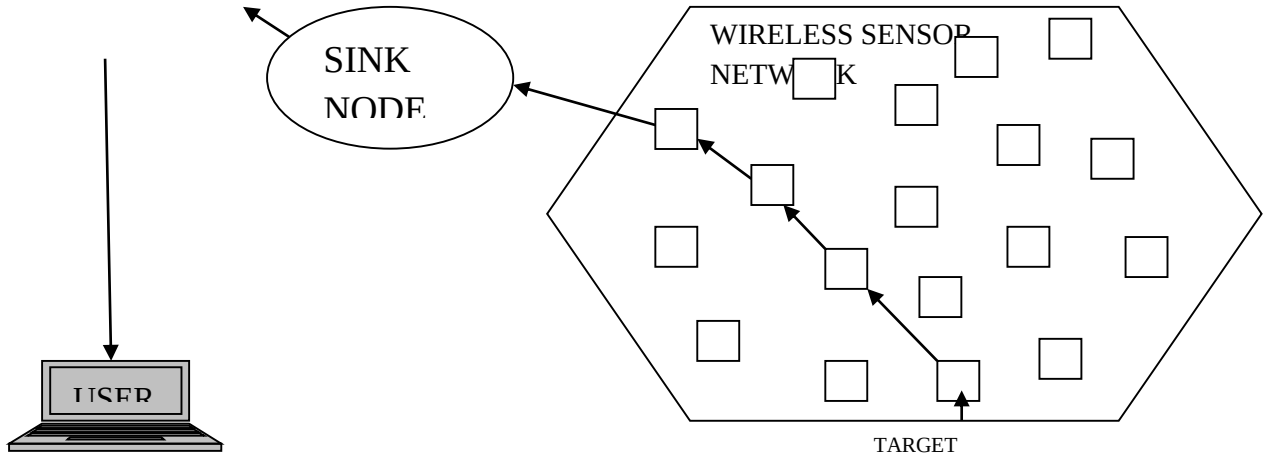


Figure:-2 Traditional model of wireless sensor network

1.3 WIRELESS SENSOR NETWORK AND ITS APPLICATIONS

Wireless sensor network is the network that consumes contiguous distributed autonomous devices that wield sensors to invigilate physical, industrials, medical as well as environmental conditions. Wireless sensor network epitomize a new generation of real time embedded system with considerably large number of communication regions. The wireless sensor network has sensing abilities and work on solar power. So wireless sensor networks are being used in many applications which are following:-

1.3.1 Military applications.

Wireless sensor networks can be deployed rapidly and self organised therefore they are very useful in military applications for sensing and monitoring hostile motion. In Military, sensor networks are used to gain and detect the large information about the explosions, enemy movement, inimical forces etc

1.3.2 Medical applications.

Wireless sensor networks have wide range of applications in medical field. Wireless sensor used to monitor the movement of integrated patient. Also diagnostics and internal process monitoring is done by wireless sensor networks.

1.3.3 Environmental applications.

There are huge numbers of applications of wireless sensor networks in environmental field. They can be used to monitor the movement of birds and animals and also to record them. Monitoring of soil, atmosphere context is also done by wireless sensor networks. Wireless sensor networks are very useful in the detection of food and forest fire.

1.3.4 Industrial and automation applications.

Wireless sensor networks have unique properties which provides satisfactory in industrial and automation applications. Wireless sensor networks mostly used to control the environment in office and industrial buildings. Vehicle detection and tracking is also done by wireless sensor networks.

1.3.5 Home applications.

Now a day's wireless sensor networks are very popular in home and house hold applications because of their excellent performance and smooth running. Wireless sensor networks give the ability to the users to control the devices according to their convenience. They can control the devices locally or remotely.

1.4 CHALLENGES OF WIRELESS SENSOR NEWORK

The challenges and limitations of wireless sensor networks are as follow:--

1. Network life span--Wireless sensor network have un-rechargeable and limited power source. Due to this sensor node life time is depend on battery life.
2. Limited energy-- The energy source in wireless sensor networks is battery. The life of wireless sensor network is fully depends on the battery which causes a problem of limitation of energy.

3. In-network processing— in wireless sensor network the embedded processing is limiting the computational power due to the economics reasons which needs to be resolved.
4. Storage search and retrieval—the memory storage is limited due to the economics reasons in wireless sensors networks.
5. Scalability-- The design of wireless sensor networks should be scalable because there are hundreds of even thousands of sensor nodes.
6. Production cost—Cost of wireless sensor networks should be low so that they can be justified.
7. Fault tolerance—Fault tolerance is the ability of the sensor network to maintain the functions properly when the failure occurs between the nodes.
8. Security—Similar to the Ad hoc network wireless sensor networks are also accessible for legitimate or illegitimate consumers so that the network should be secure.
9. Reliability-- Chemical detection and packet loss are the problems which overcome by the wireless sensor network. For those applications wireless sensor networks should be more reliable.
10. Lack of global identification
11. Redundancy

Above mentioned challenges have been summarized in tabular form for better understanding in the field of data aggregation strategies in wireless sensors networks and shown in Table2 (Verdone, Palazzo, and Zorzi 2008).

Table 2: Data aggregation challenges of wireless sensor network

Challenges	Clustering	Processing Gathering	Processing Analysis	Securing	Energy Saving
Lessening the sharing of data inLarge-Scale Wireless Sensor Network	Yes	No	No	No	No
Data aggregation in amulti layer big sensor networks	Yes	No	No	No	Yes
For large data in Wireless Sensor Network, enhancement of the compression of data	Yes	No	No	No	Yes

aggregation					
Data aggregation with specific component analysis in big data wireless Sensor Network	Yes	No	Yes	No	Yes
Data aggregation Mechanism for desire privacy	Yes	No	No	Yes	No
Analysing of large amount of data in wireless multi sensors systems	Yes	No	No	No	Yes

2. LITERATURE SURVEY

Wireless sensor network is one of the very important areas in IoT (Internet of things). According to the Kazem Sohraby, "Wireless sensor network (WSN) can be defined as the wireless network that consists of spatially distributed autonomous devices that wield sensors to invigilate physical or environmental conditions." Wireless sensor network epitomizes a new generation of real time embedded system with considerably different communication constraints from the traditional network system. Basically the wireless sensor network is comprised of computing, communication and sensing elements which gives the opportunity to the administrator to an object, sense and an instrument in the events in a specified environment.

The literature survey describe in six different categories

A. DEPLOYMENT IN WIRELESS SENSOR NETWORK

To achieve the success in deployment of wireless sensor network, different kinds of papers are reviewed to understand the problem in wireless sensor network during deployment. Each and every paper had divergent requirement and goals in deployment of wireless sensor network.

Kim and Han (2014) have represented a grid based uniform deployment technique for large scale network in order to reduce the number of sensors. This algorithm is also used to achieve the efficient deployment when best detection performance required. Huang, Chen, and Liu (2014)have gave node deployment algorithm which divided into two parts, first is continued

point based deployment and second is grid point based deployment to achieve the connectivity and coverage in wireless sensor network. Node deployment algorithm have given which divided into two parts, first is continued point based deployment and second is grid point based deployment to achieve the connectivity and coverage in wireless sensor network. The strategy ensured to provide sufficient routing path and at least one sensor monitored every point of interest. Cheffena and Mohamed (2017)were worked for monitoring and rescuing snow landslide victims, a path loss model have been deployed in various outdoor wireless sensor networks applications. The path loss was defined on wireless sensor networks at 2.425GHz by the practical sensor nodes on a road. This happened by measuring the radio frequency in snowy environment. Li, Liu, Yang, Wen, et al. (2016) provides a ground based sensing network for remote sensing applications in order to measure number of surface parameters which are land area, surface temperature and the moisture of soil. They also deployed layout at pixel scale depends on the parameter's heterogeneity with length and width about one kilometre.

B. DATA GATHERING

Wireless sensor network exhibits in many fields with large number of applications to gathered and disseminate data from environment to compile and record the information before transferring to the applications where its lies and to the base station.

Yi, Wan, Yao and Bao (2014) have proposed a partial matrix completion algorithm to analyse and recovered the missing data in wireless sensor networks. Due to this objective, matrix completion scheme used Spatio-temporal compressive data collection (STCDG) by reducing the traffic in wireless sensor network. This scheme is also applicable in low rank and short term stability. Abdulaziz and Simon (2015)have presented Multi-channel network coding clustering in the presence of bit error rate and high packet in order to the collection of mobile data. Multi-channel network coding clustering (MuCC) applied in global field by performing number of field operation on each and every bit where the bits are divided into multiple packets mathematically. Zhao and Li (2014) have presented two step approaches for data gathering by charging the jointly selected nodes. The scheme is performed by two steps, first is to dictate the mobility of the sensor for each time period where the data is gathered on located charged sensor nodes and second step is to studying about the schemes to get brilliant data gathering performance where the sensor penetrates among the different points. This scheme also increased the utility of the network and adjusted data rates.

C. WIRELESS SENSOR NETWORK PROTOCOLS

The shearing of medium access in wireless sensor network is very important factor in determining the performance of a wireless sensor network. To overcome this problem several methods have been developed to solve the medium access shearing problem. To maintain the balance between getting the better quality resource allocation decision and the necessary process to reach this decision, many researchers have given their own mechanisms.

Wang, Zeng, and Wang (2016) have proposed an Acknowledgement (ACK) protocol and the main objective of this scheme is to focus on the designing of protocols for wireless sensor network so that time synchronization takes place in sensors network in order to reducing the overhearing of neighbouring sensor nodes. In wireless sensor network time synchronization is very challenging aspects that increase the sensor cost and data fusion. Kim and An (2016)have given a fully distributed and effective PKC-Based DoS attacks-resistant scheme on Public-key cryptography (PKC).In wireless sensor network Public-key cryptography (PKC)gains large interest because it uses only Diffle-Hellman key and digital signatures which overcome the problem of authentication and different problems. Public-key cryptography (PKC) can be failed because of the false messages sending by the attackers. So this scheme takes full responsibility of public key cryptography (PKC) operations by continuously dropping the messages which have differential PKC requests. Bachir, Heusse, Duda, and Leung (2009) have represented a preamble sampling mechanism for medium access protocols (MAC) in wireless sensor networks to save the energy. In this technique, the nodes are goes on a sleep mode and off their radios to avoid the unwanted listening and wake up for a short period of time simultaneously to receive the information and to check the channel's status. The preamble was transmitting when the nodes detected the transmission action in the network. The preamble sampling takes place between the single and general transmission. Yang, Wank, and Zhang (2018) presented hybrid medium access protocol for wireless sensor networks in order to save the energy and increase the life time of the sensors motes. This protocol is basically designed for personal stations. The hybrid medium access protocol is divided in two parts, first is time division multiple access (TDMA) specially designed for increasing the energy efficiency and life of the network and second is carrier-sense multiple accessing with collision avoidance (CSMA/CA) protocols mainly designed to save the energy of wireless sensor networks.

D. LOW-POWER WIRELESS SENSOR NETWORKS

Wireless sensor networks are large numbers of applications due to their unique properties. Developing the low power wireless sensors tend to increase the storage and lifetime of the wireless sensors networks. For researchers the challenge of developing the low power sensor network is still stands.

Bachir, Bechkit, Challal and Bouabdallah (2013) have showed the outcome in over-dimensional wireless sensor network, in this the sensor nodes in this scheme are go to the rest mode or sleep mode when the temperature is low and perform normal functions when the temperature is inflated. So that the energy is only allowed to the working nodes and save energy by now allowing energy into the sensor nodes which are in sleep mode. Li, Yu and Shang(2008) have developed an intelligent hybrid power system for self-sustaining wireless sensor network which have energy management system to control the power distribution, solar panels that contains thermoelectric and photovoltaic generators for energy conversions and lithium battery work on reservoirs. The one of the main limitation of this scheme is that the battery discharges after every two hours and it has to be recharged again. During the charging the work is stopped.

E. COVERAGE IN WIRELESS SENSOR NETWORK

Chen, Li and Zhad (2016) in this paper, A reinforcement learning-based sleeps scheduling for coverage (RLSSC) scheme is represented for solar powered wireless sensor networks to get the desired coverage area. The scheme followed two-steps scheduling mechanisms. In first mechanisms, all sensor nodes are divided into groups in order to get desired coverage area. In second step Q-learning mechanism is designed which enlarge the sensor nodes into a multiple groups. This scheme schedule the sleep time of sensor nodes so the other nodes does not interfere the selected sensor nodes information and it’s reduce the energy consumption of the wireless sensor network. Berrekeyli and Ozgur (2009) has designed a Modulated backscattering (MB) Technology to get communication area by using an external radio frequency (RE) power sources in wireless passive sensor networks. These techniques enhance the lifetime of the WSN because the energy is supplied by RF external sources through antenna. So, when the antenna is switch on the information is transmitted to the desired communication nodes in wireless sensor network.

F. STORAGE IN WIRELESS SENSOR NETWORK

Wireless sensor networks needs to store large amount of data for environmental, industrial, medical and surveillance applications. Because storage unit not just only stores data, it also manages the data transmission, stores the receiving data, data manipulation and processing, and also controlled the forward encryption correlation (FEC). But memory storage is limited due to the economics reasons in wireless sensors networks.

Ahan, and Krishnamchari (2009) have compared the structured and unstructured scheme for finding quarries and data storage efficiency in wireless sensor network. In unstructured scheme, the sensor does not know where to find the copy of information and blindly search the data into the whole network. In structured scheme, the sensor node does not search the information blindly they knows exactly where to find data. The scheme decreases the storage cost and quarries of wireless sensor networks. Yang, Tao, Dutkilwicz, Huang et al (2013) in this paper, Data distributed coding (DDC) is designed for environmental applications in wireless sensor networks. In this technique the data is randomly stored in the network by distributed data coding so that whole wireless sensor networks information is sensed by base station when some of the nodes is damaged in the network. It does also enhance the energy efficiency of the network. But the problem in this scheme, the information is also stored in unnecessary nodes which increase the collision between the sensor nodes.

2.1 GAPS IN STUDY

1. On surveying these papers several gaps are found in the algorithms and technologies. The grid based deployment techniques designed by various researchers are very complex.

2. The shortcoming of the algorithms applied are modified to get desire outcome but at the cost of increase complexity in hardware and software.

3. The other deployment algorithms only applicable for large scale system and require more sensors to cover the region which increases the sensor cost.

4. The data gathering schemes have limited storage and only applicable on multiple nodes and have higher chances of overhearing due to higher cluster members.

5. The Acknowledgement (ACK) protocol, PKC-Based DoS attacks-resistant protocols and medium access (MAC) protocols are limited to small scale systems and conserve more

residual energy. Also, few sensor nodes are worked actively by sensing their own temperature and large number of nodes goes to sleep.

6. For self-sustaining wireless sensor network, an intelligent hybrid power system is developed which have energy management system to control the power distribution, solar panels that contains thermoelectric and photovoltaic generators for energy conversions and lithium battery work on reservoirs. The one of the main limitation of this scheme is that the battery discharges after every two hours and it has to be recharged again. During the charging the whole of wireless sensor network work is stopped.

3. DESCRIPTION OF TOPIC

In wireless sensor networks the data is forwarded through the number of nodes from the base station, these nodes are also known as motes. Basically motes are the wireless devices which are multifunctional and energy efficient. In other words motes are the tiny computers that work collectively in order to form a network. Motes are the key for environmental applications of wireless sensor networks. A group of motes gathers the signal from the environment to execute a particular target. There are hundreds or even thousands number of sensor nodes in wireless sensor network while other sensor network like, Ad hoc networks have very less number of nodes and even without infrastructure.

3.1TYPES OF WIRELESS SENSOR NETWORK

There are two types of wireless sensor networks:-

1. Category 1 wireless sensor network—The category1 wireless sensor network are complex devices which have multi hop radio connectivity i.e. the end device is connected to the multiple radio hop apart from the base station or forwarding nodes. The category1 wireless sensor networks are nearly invariable mesh-based system utilizes with dynamic routing between the sensor networks. Dynamic routing is supported by the forwarding nodes that provide the best path to the destination connected by the wireless links. Characteristics of category1 wireless sensor network are:-
    - The sensor nodes are acts as repeaters to support the communication in wireless sensor networks.

- With dynamic routing physical and logical network is present by the forwarding nodes.
- Radio link are used to measure the large areas are like in 1000.
- Data processing and reduction is also manages by forwarding nodes.

2. Category 2 wireless sensor network—the category2 wireless sensor networks are simple devices which have single hop radio connectivity i.e the end device is connected with the single radio hop apart from the base station or terrestrial forwarding nodes. The category2 wireless sensor networks utilizes with static routing between the wire line forwarding nodes. Characteristics of category 2 wireless sensor networks are:-
   - Sensor nodes doses not acts as a repeaters in the support of the communication in wireless sensor network
   - With static routing physical and logical network is present by the forwarding nodes.
   - Radio link are used to measure the small areas are like in 100.
   - Data processing and reduction does not manage by forwarding nodes.

3.2 ARCHITECTURE OF WIRELESS SENSOR NETWORKS

The design and elements of the architecture of wireless sensor networks is based on the category1 wireless sensor network and category2 wireless sensor networks. The architecture supports many factors such as large coverage area and population, the needs of clients, processing forwarding, routing protocols, multi hop and single hop topologies in completion of data, error rates, electrical power limitation and much more. Based on these factors the architecture of wireless sensor networks consist two parts—Hardware and software. The basic components of the wireless sensor networks are as follows:

1. Power—power supply should be depend on the applications of wireless sensors network where the sensors require the life of days or months, or years according to its need.

2. Sensor transducer/devices—make interference between the wireless network and environment. Basically the sensors for environment applications are temperature, magnetic flux, acceleration, humidity, light and pressure
3. Communication devices—the function of communication devices is to manage and control the routing protocols and maintain topologies.
4. Operating systems—the main function of operating system is to protect the software from the microprocessor at the machine-level functions. Tiny OS is one of the examples of operating systems.
5. Storage—this subsystem of architecture is manages the data transmission, stored the receiving data, data manipulation and processing, and also controlled the forward encryption correlation (FEC).

The Basic architecture of wireless sensor networks is shown in Figure:-3

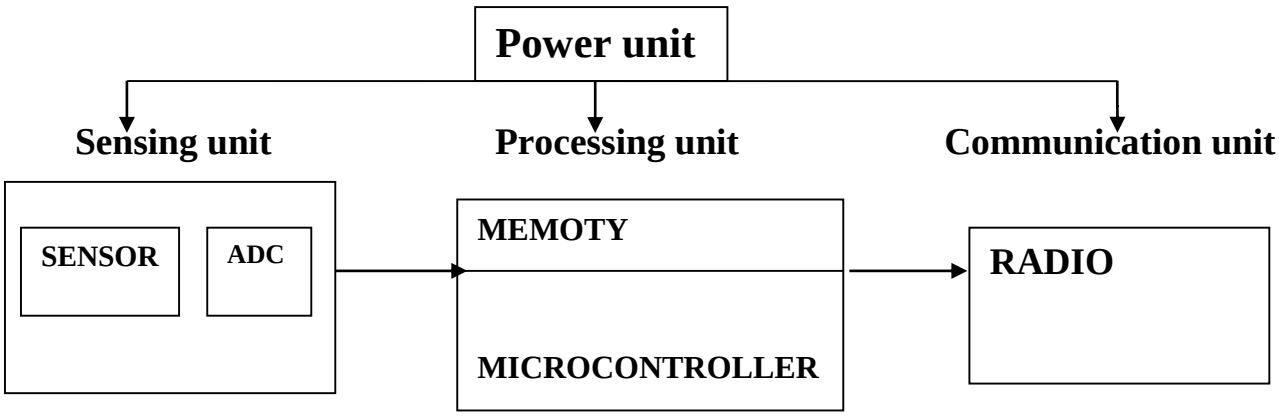
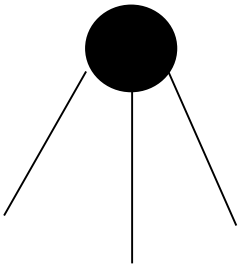


Figure: 3 Basic architecture wireless sensor networks

3.3 DATA GATHERING AND DESSEMINATION IN WIRELESS SENSOR NETWORKS

Wireless sensor network exhibits in many fields with large number of applications to gathered and disseminate data from environment to compile and record the information before transferring to the applications where its lies and to the base station. The function of wireless sensor network is to gather and forwarded the data to the base station or sink. There are two approaches which are use to fulfil the purpose of gathered and forwarded between the base station and target. Figure: 4 Shows single hop and multi hop approaches

1. Single hop approach



2. Multi hop approach

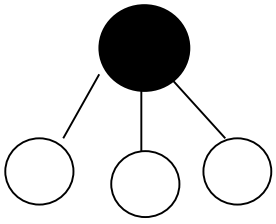


Figure: 4 Shows single hop and multi hop approaches

Low-energy adaptive clustering hierarchy—LEACH is the approach which is design to collect and deliver data to the base station. Basically low energy adaptive clustering hierarchy is a routing algorithm. In this approach network is converted into the set of clusters. Every respective cluster is controlled by the specific cluster head. Multiple tasks can be performed by the cluster head, collection of data from the other cluster members, aggregate the data and forwarding the data to the base station to the base station directly.

Power-efficient gathering in sensor information system—PEGASIS is also a routing algorithm design in order to transmit and receiving the information to the base station. PEGASIS have two main objectives, first is to decrease the delay so that data is reaches on time to the base station and second is to provide high energy efficiency and energy consumption to increase the life time of the networks.

3.4 WIRELESS SENSOR NETWORK PROTOCOLS

The shearing of medium access in wireless sensor network is the major factor in determining the performance of a wireless sensor network. To overcome this problem several methods have been developed to solve the medium access shearing problem. To collide the balance between getting the better quality resource allocation decision and the necessary process to reach this decision the methods attempts by the several mechanisms.

These methods can be divided into three categories:

(1) Random assignment,

(2) Fixed assignment and

(3) Demand assignment.

The Basic architecture of protocols is shown in Figure:-5.

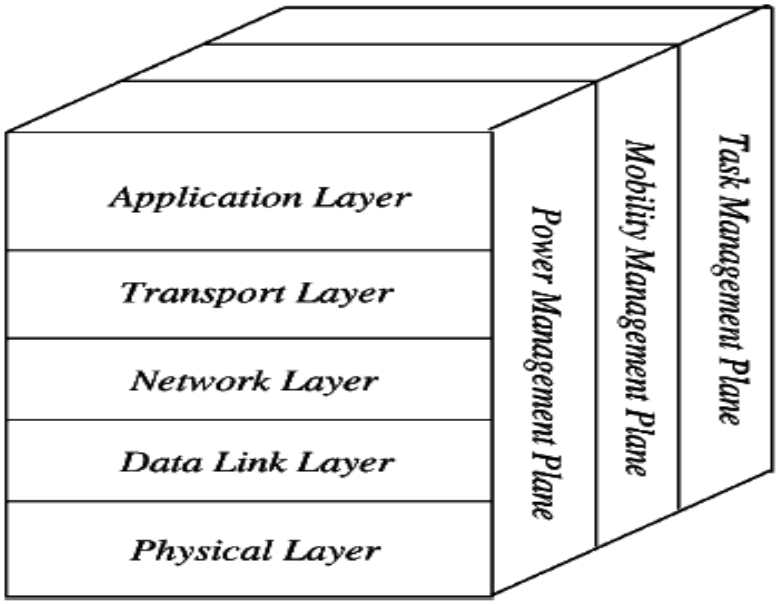


Figure: 5 Basic protocol stacks

- The application layer converts the information into a clear form and gives large number of software for various wireless sensor networks application. It is also responsible for controlling the traffic.
- When the network wants to contact with the other networks than the network needs transport layer to communicate with those networks.
- The main function of network layer is to provide routing between the sensor nodes.
- The data link layer is confirm the reliability of the network and also responsible for data detection and controlling error.
- Physical layer require when the information needs to be transmit into a physical medium.

4. RESEARCH OBJECTIVE

1. To survey the literature related to the data collection, deployment, protocols, coverage, life time and storage in wireless sensor networks and the limitations of these existing models will be investigated.

2. To understand the designing of these models designed for various applications of wireless sensor networks.

3. The new algorithms will be developed/modified to optimize the existing model of wireless sensor network for better performance.

4. The stimulation study will be carried out to compare the proposed model and existing model in a particular application of wireless sensor networks.

5. METHODOLOGY

A survey of literature related to the data collection, deployment, protocols, coverage, life time and storage in wireless sensor networks several gaps are required to be carried out. Improvement in the existing algorithms/new algorithm is to be investigated. Technologies such as, grid based deployment techniques designed by various researchers are very complex. The shortcoming of the algorithms applied is to be modified to get desire outcome. The data gathering schemes have limited storage and only applicable on multiple nodes and have higher chances of overhearing due to higher cluster members. The designed protocols limited to small scale systems and conserve more residual energy. Also, few sensor nodes are worked actively by sensing their own temperature and large number of nodes goes to sleep. To overcome these problems new algorithms will be deployed. Lastly, the simulation study of these topologies and algorithms are to be carried out for verification using several tools like MATLAB, COOJA the CONTIKI simulation tools, and NS2.

The following steps and methodology will be adopted in this research:

1. Analytical

   In this work some parameters like limited battery life, overhearing, coverage area, node deployment and blindness will be calculated analytically with the help of mathematical equations.

2. Simulation

   The performance of the proposed algorithms and protocols will be compared with the existing technique with the help of extensive simulation.

3. Experimental

Simulation of wireless sensor network protocols and algorithms is planned to be prepared to study the residual energy, battery life, overhearing, coverage area, node deployment and blindness if possible. This will show the improvement in performance of sensor nodes in real time applications.

6. RESEARCH OUTCOME

Now a day's wireless sensor networks have become novel, wide and most popular area for researchers due to its best performance in the commercial and industrial applications because wireless sensor networks uses low power computing embedded devices and advance communication and processor. Wireless sensor networks accomplish many tasks which include smart sensing, data aggregation, data processing, storage etc. To perform these tasks large number of algorithms is designed. Some gaps are found after surveying the relevant literature/algorithms. To accomplish these gaps new/modified algorithms will be investigated. So outcome of this research is an optimal model which will be deploying for wireless sensor networks in large scale for more efficiency in coverage area, lifetime, data aggregation, deployment and overhearing.

7. Proposed time plan

Researchplan														
	Sem 1	Sem 2	Sem 3	Sem 4	Sem 5	Sem 6	Sem 7	Sem 8	Sem 9	Sem 10	Sem 11	Sem 12	Sem 13	Sem 14
	(Dec '17)	(June'18)	(Dec '18)	(June'19)	(Dec '19)	(June'20)	(Dec '20)	(June'21)	(Dec '21)	(June'22)	(Dec '22)	(June'23)	(Dec '23)	(Jue '24)

Course work													
Literature review													
International paper presentation and publication													
Data collection													
Data study													
Interpretation													
Thesis submission													

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